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THE DENVER AREA AIR POLLUTION PROBLEM

Jean J. Schueneman

Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

June 1957

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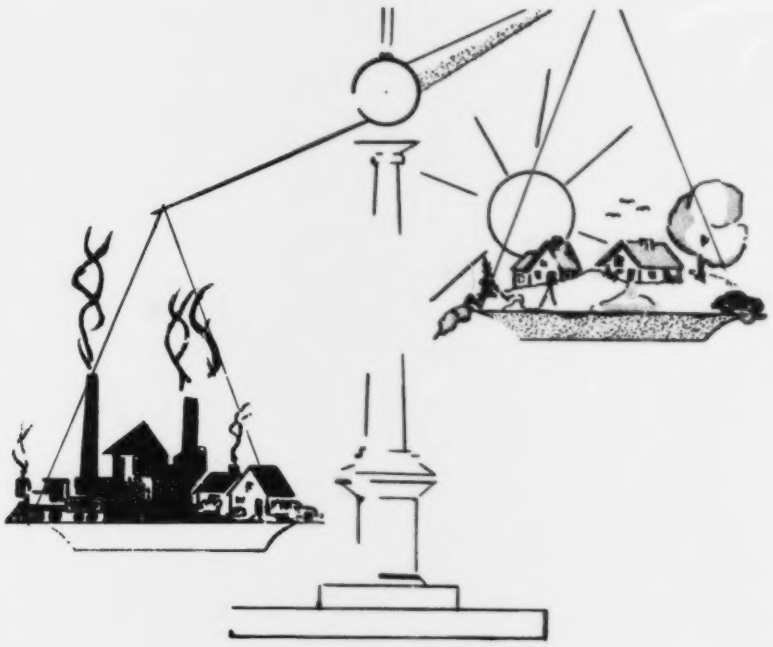

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Public Health Service

June 1957

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THE DENVER AREA

AIR POLLUTION PROBLEM

Prepared at the Request of the City and County of Denver Department of Health and Hospitals and Building Department and the Tri-County Health Department.

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State and Community Services Section
Community Air Pollution Program
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with the cooperation of

City and County of Denver Department of Health and Hospitals and Building Department, the Tri-County Health Department, Colorado State Department of Public Health, and the Public Health Service Regional Office in Denver.

Details of illustrations in this document may be better studied on microfiche.

U.S. Department of Health, Education, and Welfare
Public Health Service
Bureau of State Services
Division of Sanitary Engineering Services
Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

June 1957

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F O R E W O R D

The atmosphere is one of man's most vital natural resources. It behooves us all to use it wisely. We require an atmosphere which will not cause deleterious effects on our health, comfort, welfare or property and which can reasonably be used to receive and disperse the materials emitted to the atmosphere as a result of our activities.

Atmospheric pollution has been defined as the presence in the ambient atmosphere of substances put there by the activities of man in concentrations sufficient to interfere directly or indirectly with his comfort, safety or health, or with the full use and enjoyment of his property. A more precise definition of atmospheric pollution in terms of concentrations of polluting materials deemed to be excessive has not yet been adequately expounded. In most cases, at present, determination of the existence of excessive pollution results from the considered judgment of technical people, opinions of public officials, and expressions of the general public.

The number of communities that consider themselves confronted with an atmospheric pollution problem has been rising steadily, particularly in the last ten years. This has been brought about by increased urbanization, expanded activities of the public and the continuing desire of our citizens for a better environment. These trends are expected to continue, and atmospheric pollution problems will surely be aggravated unless action is taken to correct existing unsatisfactory conditions and to prevent the establishment of further troublesome situations. Such actions are reasonably possible in most circumstances, given suitable public support and community action.

I. INTRODUCTION

INITIATION OF STUDY

Citizens and public officials in the Denver area are vitally interested in the status of their atmospheric resources. They want to know what, if any, additional action should be taken to restore and preserve this important part of the public domain.

This feeling was evidenced by a joint request, dated December 3, 1956, from the Building Department and the Department of Health and Hospitals of the City and County of Denver and from the Tri-County Health Department through the Colorado State Department of Public Health (Appendix D). The Public Health Service was requested to assist the community by providing technical advice which would facilitate the determination of a logical course of community action relative to atmospheric pollution.

PURPOSES

The purposes of this study were developed at a conference between representatives of Denver area government agencies and the Public Health Service. The purposes of this report are to:

Review the existing and potential air pollution situation.

Review existing air pollution control activities.

Develop recommendations for legislation, organization, staff, facilities and program relative to air pollution control activities.

SCOPE

The study was limited to general consideration of available information relative to the present and possible future atmospheric pollution situation, including types of activity which cause pollution,

evidences of pollution levels, meteorological and topographical influences on dispersion of pollutants, existing or authorized governmental activity for control of pollution, and other relevant community characteristics. The study area included the City and County of Denver and the three counties surrounding it; namely, Adams, Arapahoe and Jefferson Counties, Colorado. It should be recognized that an exhaustive study could not be made within the time available.

CONDUCT OF STUDY

A public health engineer from the Community Air Pollution Program, Robert A. Taft Sanitary Engineering Center, U.S. Public Health Service, spent January 28 through February 1, 1957, in the Denver area. He was greatly assisted by Mr. Jack W. Miller, Air Pollution Supervisor of the Building Department of the City and County of Denver, and Mr. Walter N. Dashiell, Assistant Regional Engineer with the Public Health Service Regional Office in Denver. Certain information was assembled in advance of the field study by the Department of Health and Hospitals and the Building Department of the City and County of Denver and the Tri-County Health Department. Other information was obtained through examination of existing recorded information through inspection trips and through discussions with persons associated with many agencies. The cooperation and contributions of the following agencies are gratefully acknowledged:

City and County of Denver
- Building Department
- Career Service Authority
- City Air Pollution Advisory Committee
- City Attorney's Office
- Department of Health and Hospitals
- Mayor
- Planning Office
- Traffic Engineering Division
- Zoning Administration

Denver Chamber of Commerce
Denver Post
Denver Research Institute, University of Denver
Division of Industrial Medicine, University of Colorado Medical Ctr.
Intercounty Regional Planning Commission
Lowry Air Force Base, U.S. Department of the Air Force
Northern Colorado Coals, Inc.
Public Service Company of Colorado
Rocky Mountain Arsenal, U.S. Department of the Army
Rocky Mountain News
State of Colorado
    Attorney General's Office
    Department of Revenue
    Inspector of Oils
    Occupational Health Section, State Department of Public Health
Tri-County Health Department
U.S. Weather Bureau, Stapleton Field Office

II. SUMMARY OF FINDINGS

1. The present levels of atmospheric pollution are such that considerably increased activity directed toward restoration and preservation of the atmospheric resources of the area is well justified.
2. The general public and official agencies in the Denver area are concerned about the present and potential atmospheric pollution situation and have evidenced a desire to restore and preserve the purity of the atmospheric resources of the area as may be deemed necessary.
3. Present pollution in the atmosphere arises from automobiles, other transportation equipment, refuse burning, a few large and a number of small manufacturing concerns, space heating plants, commercial establishments, power generation stations, and other miscellaneous sources.
4. Unless action is taken to control the discharge of pollutants to the atmosphere, the pollution problem can be expected to be considerably greater in the future. For example, it is estimated that in 1970 emissions from automobiles will be about 2.7 times those of 1950; emissions from manufacturing plants will be about 30 percent greater than in 1951; space heating, refuse burning, and general commercial establishment emissions will be 7 to 21 percent greater than in 1956.
5. The meteorological and topographical features of the area are such that dispersion of pollutants discharged into the air is only moderately good. These features would probably lend themselves well to planning of land use in such a way that public exposure to pollutants could be minimized.

6. Pollution emissions associated with space heating, refuse disposal, transportation, and commercial establishments are fairly generally distributed throughout the area, with densities consistent with the degree of urbanization. Manufacturing plants which may discharge pollutants are much more prevalent in the City and County of Denver than in the surrounding area and are concentrated near the South Platte River, particularly in the area north of the central commercial area. However, the percentage of the total metropolitan area manufacturing activity which is located within Denver County itself has been decreasing and is expected to decrease further.

7. Seasonal cycles of pollution emissions from refuse burning and motor vehicle fuel usage tend to offset the seasonal fluctuations of pollution discharged by space heating equipment. Pollution from manufacturing and most other commercial activities are fairly uniform throughout the year.

8. Present air pollution control activities cannot be expected to achieve a satisfactory degree of control of the problem.

9. A metropolitan area-wide pollution control agency would be desirable but may not be achieved for considerable time. Two agencies, one serving the City and County of Denver and the other serving Adams, Arapahoe, and Jefferson Counties, could coordinate their efforts and utilize their resources in such a manner that air pollution control could proceed satisfactorily throughout the area. Present enabling authority for such action is probably adequate.

10. Existing legislation in the City and County of Denver with regard to zoning, buildings, nuisances, and refuse contain certain provisions

which can provide the bases of auxiliary facets of the over-all control pattern. Administrative arrangements to avoid duplication of effort and nonuniformity of standards will be necessary.

11. The State of Colorado has the basic skills and some equipment available for giving technical assistance to local agencies but with the present budget, such assistance probably will not be extensive.

12. Existing legislation in the City and County of Denver providing for regulation of air pollution is felt to be in need of revision. A proposed air pollution ordinance is thought to be an improvement but certain further consideration of the proposal is warranted.

III. RECOMMENDATIONS

CONTROL PROGRAM NEED

The City and County of Denver and Adams, Arapahoe, and Jefferson Counties could well provide for considerably increased activity in the field of air pollution control.

LEGISLATION

In the City and County of Denver, consideration could be given to revision of existing air pollution control legislation. The presently proposed revised ordinance, with some modification, is felt to be suitable for this purpose.

In Adams, Arapahoe, and Jefferson Counties, consideration could be given to adoption of some legislation which would provide a legal basis for an air pollution control activity. It is felt that rules and regulations adopted by the Tri-County Board of Health would be suitable for this purpose. If rules and regulations are adopted by the Colorado State Board of Health, they may be utilized by the Tri-County Health Department.

ORGANIZATION OF CONTROL PROGRAM

Although an air pollution control program serving the entire metropolitan area is felt to be desirable, it is deemed expedient at this time for the City and County of Denver and the Tri-County area to operate separate, coordinated programs.

In the City and County of Denver, the control program could be administered by the Building Department or the Department of Health and Hospitals, as found most appropriate by local authorities.

In Adams, Arapahoe and Jefferson Counties, the Tri-County Health Department appears best suited to administer a control program.

Air pollution control units in the two areas could coordinate their efforts, make joint studies and share personnel and facilities on either or both formal contract and informal bases.

Close liaison should be maintained with public and private groups and individuals concerned with matters related to air pollution and community welfare.

Activities within the respective governmental units which are related to air pollution control should be administered in such a way that maximum efficiency, minimum duplication and nonuniformity, and the best possible public service can be achieved.

NATURE OF AIR POLLUTION PROGRAMS

The air pollution programs of the two areas might well include the following facets:

a. An air pollution emission inventory.

b. A meteorological study for use in area planning as related to air pollution.

c. Promotion of improved refuse handling programs on the basis of studies already completed.

d. Program initiated determination of violations of air pollution emission regulations with suitable abatement action.

e. Regulation of certain new installations which may cause pollution.

f. A modest air quality measurement program.

g. Abatement of the causes of justified public complaints.

h. A planned program of control of those classes of activities causing air pollution.

i. Scientific investigations of emissions of pollutants to the atmosphere.

j. Compilation of a register of air pollution sources.

k. A program of public education.

l. Support for the work of others which will benefit the area.

AIR POLLUTION PROGRAM COSTS AND PERSONNEL

In the City and County of Denver, a staff of 6 to 12 people could be considered, with a total program cost of $38,000 to $80,000 per year.

In the Tri-County area, a staff of 4 to 7 people could be considered, with a total program cost of $26,000 to $45,000 per year.

IV. THE AIR POLLUTION SITUATION--NOW AND FUTURE

PUBLIC CONCERN

Denver area citizens are proud of the clear skies and the fresh mountain air found in Denver and the reputation of their city as the cleanest in the world. Each year Denver attracts about 1,800,000 tourists who come to enjoy these fine attributes and who spend an estimated $68,000,000. There is a desire to preserve these important assests. However, there is growing concern that the air is becoming polluted by activities of the ever-increasing number of people and industries attracted to the area. This concern was evidenced by the Mayor of Denver when, in 1955, he appointed a committee to advise the community on air pollution matters. The committee proposed legislation (Appendix C) which would provide a basis for intensified air pollution control activities. Further evidence of public concern are the 1250 public complaints about air pollution lodged with city officials last year and the sizable number received by officials in the Tri-County area. The press has carried a substantial number of news reports and editorials reflecting concern about air pollution.

INDICATIONS OF PRESENT POLLUTION LEVELS

Pollution levels in Denver, as indicated by the weight of suspended particulate matter in the air, are of the same order but with a tendency toward higher levels than those reported in other cities of comparable size. Scientific data about other pollutants are not available, with the exception of information developed by the Colorado State Department of Public Health and others relative to radioactive material in the air. No

concentrations of radioactive materials presently considered hazardous were reported.

It was reported that visibility is reduced considerably by the presence of pollutants in the air on quite a number of days each year. These occurrences have probably drawn the attention of the public to air pollution more than any other aspect of the problem. On one day during this survey, visibility was decreased to a degree which indicated that the pollution problem could well be one of concern.

The supervisor of the Air Pollution Division of the Denver Building Department reported that 1250 public complaints were received during 1956. A sizable number were also received by the Tri-County Health Department. These complaints usually reflect the existence of problems in the neighborhood of particular sources of pollution rather than high pollution levels over broad areas. The Air Pollution Division in Denver made specific mention of problems associated with junk auto body burning, diesel bus exhausts, refuse burning, foundries, asphaltic road mix plants, oil refinery sludge burning, various smoke and odor problems, and surface dust from unpaved streets and other areas. The Tri-County Health Department made specific mention of problems associated with hog farms, sewage disposal plants, fertilizer plants, animal slaughtering, brick manufacture, brewing, oil refineries, roofing manufacture, power generation, and junk auto body burning.

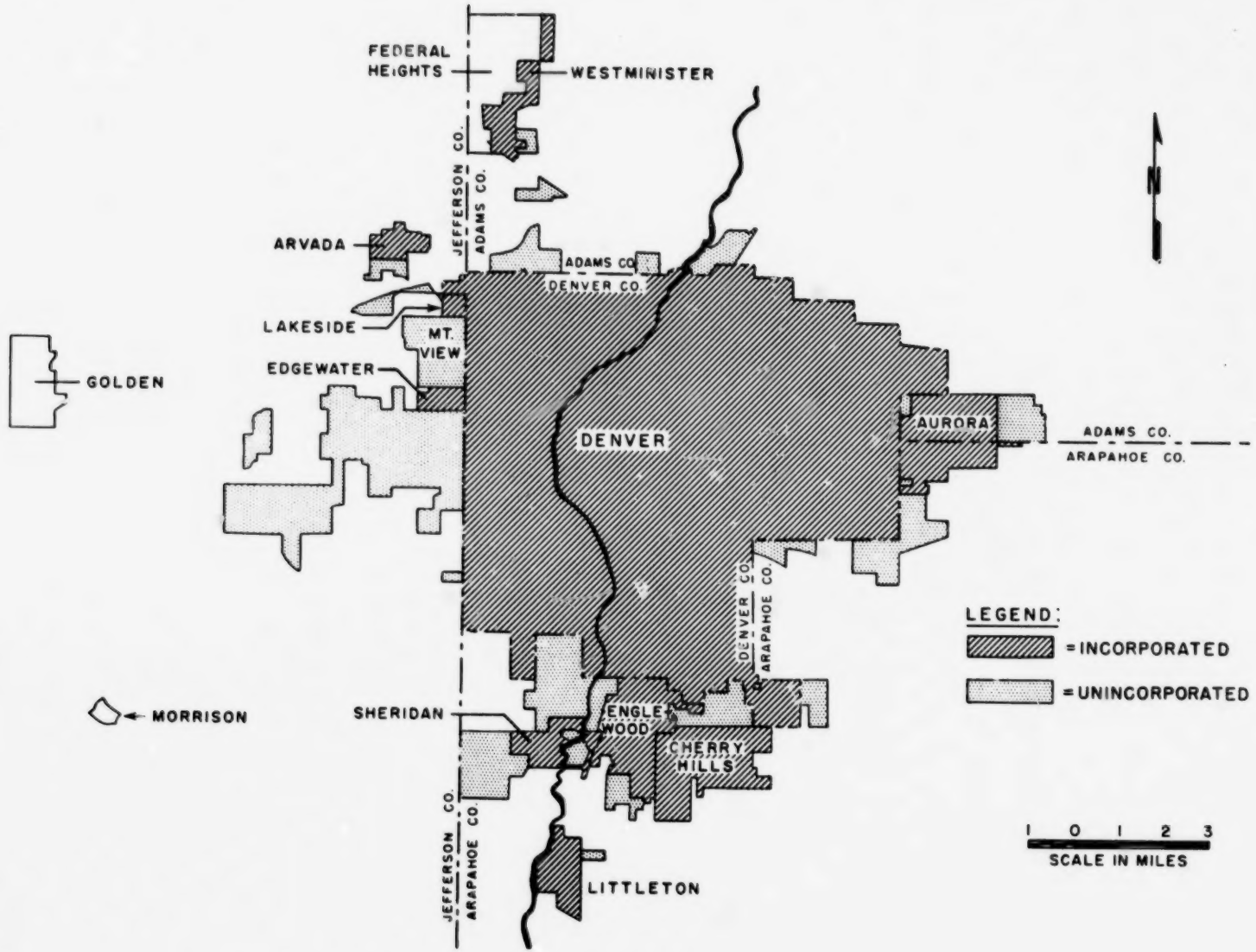
GENERAL CONSIDERATIONS

Population: The City and County of Denver had an estimated population of 509,000 in October 1956. In Jefferson, Adams, and Arapahoe Counties surrounding Denver there were 260,000 people, including 178,400

living in 18 urban places in the vicinity of Denver.[1] Figure 1 shows the Denver urbanized area as reported in 1950.[2] The population of the area is growing rapidly and has experienced a growth rate somewhat above average for United States cities in its size class. A large proportion of this growth has occurred outside of the City and County of Denver. The population of the Denver standard metropolitan area (Denver, Adams, Arapahoe, and Jefferson Counties) in 1970 is estimated at 819,000 to 931,000[3], an increase of 7 to 21 percent over the present. In this event, assuming that public activities which cause pollution (automobile usage, refuse disposal, fuel usage, manufacturing types, etc.) are of the same nature then as they are now, an increase of 7 to 21 percent in pollution levels would be expected. However, other factors, explained later, will also influence this pollution trend.

Area and Population Density: Compared to other cities Denver is not very densely populated (Table 5, Appendix A), having a population density of 6690 persons per square mile in 1954.[12] The population density and area of the city have increased steadily along with the population. Denver has followed the general policy of encouraging annexation of contiguous areas when the status of the improvements in these areas is such that they can be economically and efficiently served by the city. It is expected that this trend will continue (Table 6, Appendix A).

The fact that Denver is not very densely populated, comparatively, means that pollution discharged to the atmosphere, in general, will be dispersed in a greater volume of air than in more densely populated areas, and therefore would tend toward lower pollution concentrations, other factors being equal. However, the trend toward greater population



DENVER URBANIZED AREA – 1950 (2)

FIGURE 1

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densities in Denver will tend to nullify this advantage.

Denver's history of annexation of contiguous areas has acted to maintain a greater portion of the population of the urbanized area within the city as compared to population in contiguous areas outside the city. However, the proportion of the population of the standard metropolitan area within the city has decreased from 82 percent in 1930 to 66 percent in 1956.[1,4] This indicates that in air pollution control work there is and will be reason for integration or close coordination of all such activities in the metropolitan area.

General Character of Industry and Employment: In 1940 and 1950, an average of 80 percent of total employment was in trade and service industries of one kind or another, while employment in manufacturing averaged 17 percent.[5] Average employment in manufacturing in other metropolitan areas of 500,000 to 850,000 was 23 percent in 1950.[6] There is not extensive activity in those industries which would ordinarily be expected to discharge great quantities of air pollutants. During the decade from 1940 to 1950 there was no material change in the occupational pattern, (Table 7, Appendix A). Estimates for the future predict no marked change in the occupational pattern in 1970.[7] This would indicate that no great change in atmospheric pollution due to changes in the proportion of the various kinds of activities is to be expected.

SOURCES OF POLLUTION

Fuel Usage: The predominant fuel in the Denver area is gas. The trend toward use of gas began in 1928 when natural gas was brought to the area. It is now reported that 98 percent of the homes are heated with gas

and that nearly all new installations for space heating are gas fired. The Public Service Company of Colorado, which supplies all the piped gas for the area, reported the gas usage shown in Table 1.

TABLE 1--USE OF NATURAL GAS IN THE GREATER DENVER AREA IN HUNDRED THOUSANDS OF CUBIC FEET[16]

Year	Industrial	Commercial	Residential	Total	Central station power plants
1930	1,306	695	3,005	5,006	Not reported
1940	3,012	1,142	4,461	8,615	Not reported
1950	12,537	8,239	17,406	38,182	Not reported
1956	16,178	14,872	29,697	60,747	23, 147

A number of industrial gas users are on an interruptable service basis and during cold weather, may use stand-by firing equipment with other fuels. Although gas is the cleanest present-day fuel, it does produce some air pollutants upon combustion, (Table 12, Appendix B).

Coal is used in a number of industrial processes; in some commercial heating units, including an estimated 200 boilers of which nearly all are underfeed stoker-fired; in about 150 public schools of which about 75 percent are hand-fired; and in a few domestic heating plants and other installations. Considerable quantities are used in part-time operation of two central station electricity generating plants, and at two large federal government establishments. About half of the coal used in the metropolitan area is used in the City and County of Denver. Estimated coal consumption is shown in Table 2.

The coal, largely from Colorado mines, may be lignite from northern Colorado, bituminous from the southern and northwestern parts of the State, or anthracite from the western regions. The coal used in the two major

TABLE 2--ESTIMATED COAL USAGE IN GREATER DENVER AREA[15]
(TONS)

Year	City and County of Denver	Other metropolitan area	Total
1930	1,670,000	330,000	2,000,000
1956	217,000	216,000	433,000

power stations contains about 0.5 percent sulfur, 30 to 35 percent volatile matter, and 6 to 10 percent ash.

It has been noted recently that use of coal on a national basis has stopped the decline of past years and has taken an upward movement. Whether or not this trend will continue and whether or not it will apply in the Denver area is not yet clear. However, use of coal for the generation of electricity is expected to increase for at least a few years as it will in metallurgical and other processes. These factors, along with the fact that most of the probable changes from coal to other fuels have already been made, could well result in an over-all increase in coal usage in the Denver area. Use of coal can result in the discharge of smoke, soot, fly ash, sulfur dioxide, and other pollutants to the atmosphere, (Table 17, Appendix B). From an air pollution standpoint, coal is generally considered the least desirable of the three commonly used fuels.

Petroleum fuels, including heating, distillate, and residual oils and kerosene, are used to some extent in the Denver area. No exact data could be obtained concerning their usage but data were available for the State of Colorado. Based on a population ratio of 2.1 to 1 for Colorado and the Denver standard metropolitan area respectively, the Colorado usage was prorated to obtain the approximate use of these fuels in the Denver

area as shown in Table 3.

TABLE 3--PETROLEUM FUEL USAGE IN THE DENVER METROPOLITAN AREA (BARRELS)[17]

Year	Residual fuel oils	Heating oil	Distillate and kerosene range oils	Total
1950	504,000	375,000	124,000	1,003,000
1955	655,000	706,000	147,000	1,508,000

Use of these petroleum fuels can contribute smoke and other pollutants to the atmosphere, (Table 12, Appendix B).

Fuel usage for industrial and commercial purposes is fairly uniform throughout the year while fuel used for space heating varies widely, depending on the weather. Pollution emissions during the period November through March will be considerably higher than during the other months. Based on the long-term pattern of heating degree days, the monthly heating fuel usage, as percent of the total fuel used for heating in a year, would be as follows:

January	18%	May	5%	Septemer	2%
February	15%	June	1%	October	7%
March	14%	July	0	November	12%
April	9%	August	0	December	17%

The foregoing information indicates that there are some air pollution problems arising from use of fuels but compared to many other cities, these problems are relatively minor. Means for control of smoke and fly ash from fuel-burning installations are generally available but control of certain gaseous contaminants has not been developed, with the exception of some limited techniques for control of sulfur dioxide.

Transportation: Use of fuels in all kinds of transportation equipment results in the discharge of substantial quantities of pollutants to the atmosphere. Data on emissions from gasoline and diesel engines are given in Tables 15 and 16, Appendix B.

When considered in terms of total pollutants emitted collectively by all vehicles of one type, automobiles make the greatest contribution to atmospheric pollution of all types of transportation equipment. The number of automobiles is increasing by virtue of a growing population as they are also in terms of automobiles per capita. Further, the number of miles driven in a year per automobile is increasing. It has been estimated that by 1970, total miles traveled in the Denver area will be 2.7 times that of 1950.[18] This will cause about a 2.7-fold increase in pollution from these sources unless some factor such as changes in fuels or engines, use of control equipment or some other factor comes into play. (Table 4).

TABLE 4--USE OF AUTOMOBILES AND AUTOMOTIVE FUELS--DENVER METROPOLITAN AREA

Year	Auto registrations[18,19]	Persons per automobile[18]	Miles per auto per year[18]	Gasoline consumed (gals.) (estimated)
1930	- - -	3.00	8,400	- - - - -
1940	123,802	2.75	9,400	78,000,000
1950	188,353	2.50	10,100	127,000,000
1956	294,048	- -	- - -	202,500,000
1960	344,000	2.25	10,900	250,000,000
1970	470,500	2.00	11,600	370,000,000

Movement of goods by truck is also rapidly expanding. There are presently over 41,000 trucks of all kinds registered in the Denver area. These vehicles use an estimated 49,000,000 gallons of fuel a year. About

2400 highway truck trips are made in and out of the Denver area every day. These are about one-third diesel powered and two-thirds gasoline powered. A substantial amount of pollution results from operation of those trucks. An increase similar to that estimated for automobiles would be expected by 1970.

There are presently 300 diesel powered buses operating on routes in the Denver area. Each of these buses consumes an estimated 8400 gallons of fuel a year or a total of 2,252,000 gallons. This operation will result in some pollution but it will be a small total quantity compared to the total emissions from automobiles and trucks. There are also about 175 highway bus trips in and out of the Denver area each day.

Although their contribution to over-all pollution can be considered relatively small, diesel buses are often the cause of public complaints because their engine exhausts have an objectionable odor which, under certain conditions, can cause physiological reactions. This situation is accentuated by the fact that buses operate in areas of heavy auto and pedestrian traffic where people are exposed to the emissions in close proximity to their point of discharge.

Motor vehicle fuel usage, as other fuel usage, has a rather pronounced seasonal pattern. The percentage of the year's total vehicle fuel used in each month during 1955 in Colorado is as follows:[17]

January	6.9	May	8.3	September	9.4
February	6.2	June	9.9	October	9.1
March	7.7	July	10.2	November	8.0
April	8.4	August	10.3	December	5.7

This pattern is the reverse of the heating fuel usage pattern and thus, total pollution emissions will tend toward a more uniform level throughout the year, in a very broad sense, than if they varied in the

same way. In addition to emissions to the atmosphere caused by burning fuel in transportation equipment, considerable quantities of liquid fuels in vapor form are released in storage and handling activities. Data on some such losses are given after Table 17, Appendix B.

At present, there are no generally accepted devices for control of emissions from automobiles and diesel engines. In Los Angeles, such devices have been approved for use on gasoline engine trucks and buses. In the case of diesel engine vehicles, proper attention to fuel specifications and engine maintenance will serve to reduce emissions to some limited extent. Much research is being conducted to devise satisfactory means for the control of emissions from automotive transportation equipment.

There are presently 45 diesel, 10 oil-fired steam, and 3 coal-fired steam locomotives doing switching work in the Denver area. There are no coal-fired road engines operating through Denver; 7 oil-fired steam and 65 diesel-powered trains enter or leave on the average day. Coal-fired locomotives are generally considered to be least desirable from an air pollution standpoint but some pollution results from the other two types. Data on emissions from burning fuel oil and diesel fuel are in Tables 12 and 16, Appendix B. In general, the air pollution problem associated with railroads can be considered minor in the Denver area.

The area is served by 5 trunk line air carriers and two local service carriers. Numerous flights arrive and leave daily. There is also substantial activity by military aircraft in the area. All of these activities will result in some air pollution, although the contribution to the total is probably not of great importance.

Manufacturing: As previously indicated, the Denver area, with only about 17 percent of total employment in manufacturing, is not primarily a manufacturing center. In 1951, however, 40,264 people were employed in 515 establishments in the Denver standard metropolitan area.[9] The number of employees and establishments in major manufacturing industry groups is shown in Table 8, Appendix A. In terms of existing air pollution problems, as indicated by these data, manufacturing industries can be considered important, although the number, sizes and types of operations usually associated with problems of great magnitude are not present. Estimates for 1970 indicate an increase of about 30 percent in manufacturing employment with no great change in the kinds of manufacturing activity (Table 8, Appendix A). Pollution emissions therefore would be of the same general character and, very roughly, 30 percent greater in 1970 as compared to 1951.

Manufacturing plants in the Denver area are predominately small with 85 percent employing fewer than 100 persons. However, 4 large firms alone accounted for 27 percent of the total factory employment in 1951. There were 82 establishments employing 100 or more people in December of 1951 (Table 9, Appendix A).

Of the 82 establishments in the area employing 100 or more people, about 30 would be suspected of discharging relatively large quantities of pollution. These include foundries, a smelter, a brewery, oil refineries, plants engaged in meat packing, food processing, wood creosoting, gravel processing, brick and tile making, chemical manufacturing, rubber goods production, and the making of porcelain products. It is indicated that while the nature of possible air pollution problems that would

confront any control organization may be fairly complex and diverse, the number of very large plants to consider would be fairly small. Pollution problems of lesser magnitude also would be expected from a variety of smaller manufacturing establishments.

Of the manufacturing establishments and manufacturing employment in the Denver standard metropolitan area, a very large majority are in the City and County of Denver. This is true for all sizes of establishments. However, during the period 1947 through 1954, the proportion in the City and County of Denver decreased in relationship to those in the other three counties in the standard metropolitan area[20] (Table 10, Appendix A).

In terms of any possible control activity, this ratio indicates that at this time a Denver County program could see to provision of any necessary controls in about 84 percent of the manufacturing establishments, leaving the other 16 percent, some of which are reported to create air pollution problems, without effective official control jurisdiction. The trend toward location of establishments outside of Denver County further indicates the need for control jurisdiction throughout the metropolitan area.

Employment in these manufacturing establishments is almost uniform throughout the year, varying from the annual average only from about 98 percent in May to 102 percent in August.[11] Therefore, pollution discharged to the atmosphere from these sources will be fairly uniform throughout the year, not including emissions from space heating sources.

Refuse Disposal: In Denver County, all garbage is collected by contract haulers and, after cooking, is disposed of by feeding to hogs.

In Jefferson, Arapahoe and Adams Counties, garbage is collected by private haulers under a franchise issued by county authorities. It also is disposed of by feeding to hogs. There are about 20 hog-feeding farms operating in Jefferson, Adams, and Arapahoe Counties. None are located in Denver County, but some are located just outside the county limits. These hog farms are reported to cause complaints from the public about objectionable odors and flies.

In Denver County, a considerable proportion of all household combustible rubbish is being burned on the premises where it is produced, with a higher corresponding proportion in Jefferson, Arapahoe and Adams Counties. It is burned in a wide variety of ashpits, back-yard incinerators, wire baskets, oil drums, open fires, etc. This practice creates nuisance problems in the immediate vicinity of each burning operation because of smoke, odors and blowing ashes. It also causes a large contribution to the general pollution loading over the area. Emissions of pollutants from burning rubbish in back-yard incinerators are given in Table 14, Appendix B.

The amount of household rubbish varies considerably during the year, ranging from a low of about 60 percent of the annual average in February to about 120 percent in June. A major factor in this variation is the inclusion of grass cuttings and yard brush during the summer and of leaves during the fall months.[13] Seasonal variations in the practice of burning household rubbish were not determined, but the practice is probably much more extensive during the warm months.

Refuse disposal, excluding garbage, in Denver County is also carried on at one dump where burning is common, and at five modified sanitary

landfills where fires are fairly infrequent. Local nuisance problems and release of considerable quantities of pollutants would be expected at the burning dump while air pollution problems caused by the five modified sanitary landfills are reported to be minor. In Jefferson, Adams and Arapahoe Counties, refuse, excluding garbage, is deposited at 14 sites. Burning is reported to be fairly common at about half of them and pollution problems would be expected. A number of private, commercial and governmental refuse disposal operations (dumps) were also reported to cause release of considerable quantities of smoke, odors, etc.

There are said to be less than 50 flue-fed incinerators in Denver County at this time and the building code prohibits construction of new ones. Therefore, the magnitude of smoke, odor and fly ash problems usually associated with these units is not great.

There are a number of incinerators in use at commercial and other establishments, a few of which are reported to cause smoke, odor and fly ash problems. Detailed information on the extent of this problem was not available, but the lack of any considerable number of reported problems indicates that such units are either few in number or operated in such a way that no great smoke or nuisance type problems are created. Information as to pollutants released to the air by combustion of refuse in incinerators is given in Table 13, Appendix B.

Other Business Activity: Establishments engaged in auto body salvage, concrete batching, asphaltic road mix preparation, dry cleaning, laundering, poultry dressing, sand blasting, auto body repair, welding, tire recapping, automobile cleaning, metal plating, and others may create nuisance problems in their immediate neighborhoods and make some contribution

to the over-all pollution load. Auto body burning as a part of salvage operations is reported to be particularly troublesome.

Other Pollution Sources: Some concern has been expressed by State officials concerning radioactive materials in the air resulting from atomic weapons tests, atomic weapon and reactor development and other atomic energy activities. Some investigations of this pollution factor have been made by the State Department of Public Health and others. No condition thought to be hazardous has been reported, but continued investigation is warranted.

Smoke is released during exercises at a federal firefighting school. Unpaved streets and areas denuded by construction, playgrounds, etc. have caused some dust problems.

Agricultural operations, including application of insecticides, fertilizers and herbicides, soil tillage and burning of plant residues, may result in atmospheric pollution.

Deficiency in rainfall during the period 1950-56 has resulted in unusually high quantities of surface dust being picked up and carried by the wind. Similar conditions occurred during the period 1935-40 and 1890-95.[21]

METEOROLOGY, TOPOGRAPHY AND LAND USE

Denver lies about 40 miles east of the main range of the Rocky Mountains, which rise 10,000 to 14,000 feet above sea level, and about 18 miles east of the foothills which rise 6,000 to 8,000 feet above sea level. The Palmer Lake Divide lies about 40 miles south of Denver. Its altitude varies from 8,500 feet where it joins the Rockies to about 4,000 feet near the Kansas line. The South Platte River flows from the

southwest to the northeast through the heart of Denver. Denver County is fairly level and has an elevation of about 5,250 feet above sea level in the central portions of the city.[22]

Winds (and other weather factors) in the Denver area are greatly influenced by the proximity of the mountains. The predominant winds during the period 7-8 p.m. and continuing until 9-11 a.m. are from the south southwest with a velocity of 5 to 8 miles per hour. This flow is strongly influenced by drainage currents from the mountains. During the period 9-11 a.m. and continuing until 7-8 p.m., the predominant winds are from the northeast, the reverse direction from the above, at 6 to 11 miles per hour (Table 11, Appendix A). This flow is strongly influenced by an upslope air movement caused by the sun's warming of the eastern slopes of the mountains. The annual average wind velocity is 7.5 miles per hour, a rather low figure compared to many other areas. Based on average hourly wind observations, frequency of calm conditions is 1 to 2 percent of the time; winds of 0 to 3 miles per hour prevail from 15 to 23 percent of the time on a monthly basis and average 18 percent on an annual basis; winds of 4 to 7 miles per hour prevail from 24 to 37 percent of the time on a monthly basis and average 30 percent on an annual basis.[25]

Situated a long distance from any major moisture source, and separated from the Pacific Ocean source by a high mountain barrier, Denver enjoys a low relative humidity (63 percent at 5:30 a.m. and 37 percent at 11:30 a.m., average), low average precipitation (14.2 inches per year), and considerable clear sky sunshine (67 percent of possible average). Heavy fog occurs on an average of only four days a year.[26]

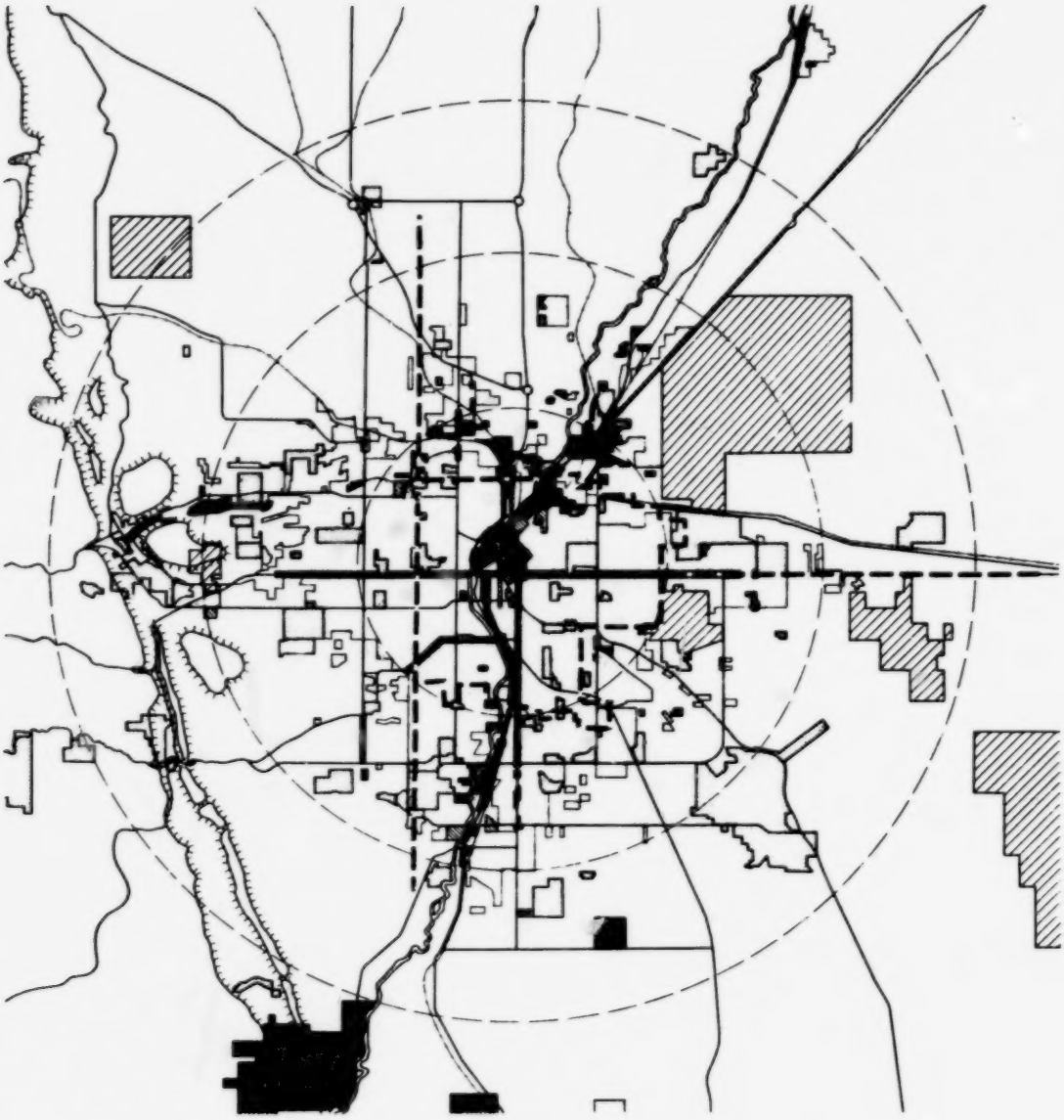
Temperature inversions (the condition which exists in the atmosphere when temperature increases rather than decreases with height through a layer of air) occur on about two-thirds of all days. They are usually dissipated within a short time with only about six occasions per year when an inversion persists for more than 24 hours.[24] When inversions exist, dispersion of pollutants is generally poor.

The foregoing information concerning topography and meteorology in the Denver area tends to indicate that pollutants discharged into the air will not be dispersed in the most efficient way. The rather weak average wind velocities, frequent occurrence of low level temperature inversions and the oscillating wind direction pattern are the principal adverse meteorological factors. Action of the last factor would tend to cause polluted air to return to the area after once being swept out. This would occur near the times of the twice-daily reversal of flow direction. Of the two flow direction reversals, the one occurring in the morning would contribute more substantially to accumulation of pollution since pollutants discharged during the night and early morning hours, with light winds and temperature inversions likely to prevail, would tend to remain in the downwind area to be returned by the reverse wind flow and be added to the pollution emissions then existing. The evening flow direction reversal would tend to be less important since dispersion brought about by the stronger winds and better vertical mixing during the hours prior to the reverse of wind flow would tend to remove pollutants from the downwind area to such a degree that they would be less likely to return. Prevailing meteorological factors that tend to promote rapid dispersion of pollutants and thus modify the foregoing factors are low relative

humidities, infrequent heavy fog occurrence and high percentage of possible sunshine. These factors permit more rapid heating of the earth's surface in the morning hours, thus causing the air near the ground to be warmed. This warm, light air rises, carrying pollutants with it and favoring the breakup of poor dispersion conditions associated with temperature inversions.

The location of areas likely to be most adversely affected by pollution with relation to location of major sources of pollution, as influenced by air flow patterns, is of considerable importance in judging the pollution situation. The location of pollution sources is reflected in some measure by the generalized land use pattern in the area shown in Figure 2. Sources of pollution, such as household refuse burning, space heating, and automotive exhausts, are generally distributed throughout the area consistent with the degree of urbanization, with automotive emissions concentrated in the central portion and on major thoroughfares. Commercial sources of pollution are also fairly generally dispersed when considering the area as a whole, although they are grouped together in a number of area and strip type centers. Industrial areas are mainly concentrated along the South Platte River (Figure 2), with the greatest number of larger establishments located north of the central business area. Refuse disposal sites are scattered over the urbanized area (Figure 3).

The location of pollution sources, when considered in the light of prevailing meteorological patterns, is such that the easterly and westerly portions of the area will be afforded some relatively greater degree of freedom from pollutants than the central, northerly, and southerly portions. The meteorological and topographical situation appears to be one which



DENVER REGION
GENERALIZED LAND USE — 1956 (27)

- CENTRAL BUSINESS DISTRICT
- INDUSTRY & RAILROADS
- MILITARY & DEFENCE INSTALLATIONS
- RAILROADS
- MAJOR ROADS
- COUNTY LINES
- RESIDENTIAL
- COMMERCIAL
- PUBLIC & SEMI PUBLIC
- MOUNTAINS
- 5 MILE CIRCLES

FIGURE 2

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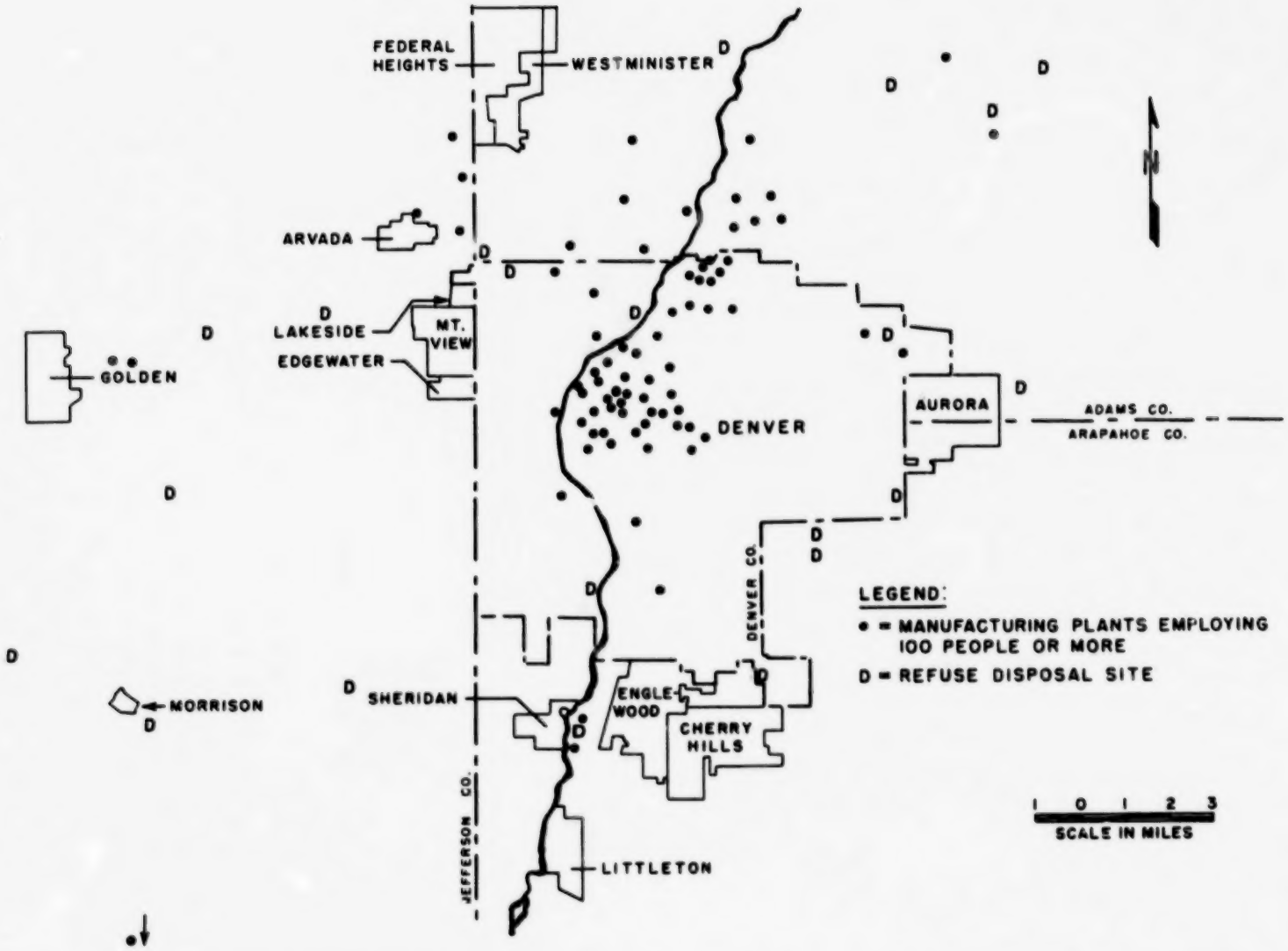

LOCATION OF MAJOR MANUFACTURING PLANTS AND REFUSE DISPOSAL SITES
DENVER AREA - 1954
FIGURE 3

would allow favorable advance planning of land uses to take maximum advantage of the air flow patterns by placing major pollution sources in such relation to residential areas that exposure to pollutants is minimized.

V. PRESENT AUTHORITY AND ACTIVITY

CITY AND COUNTY OF DENVER

Air Pollution Control: Article 762 of the Revised Municipal Code of the City and County of Denver provides legal authority for air pollution control activities, especially smoke abatement. This ordinance, adopted in 1948, is lacking in a number of important features necessary for a fully successful control program. This deficiency has been recognized by Denver officials and the air pollution committee appointed by the mayor has drafted a revision of the article (Appendix C). The proposed draft is generally an improvement of the existing article but contains some facets which bear further consideration.

Under the terms of Article 762, one man is engaged full time in air pollution control work. His activities consist largely of handling public complaints. He accomplishes a great deal of good, but the efforts of this one man cannot be expected to fulfill the need for an effective program nor to fully implement the provisions of the existing article.

Zoning: The zoning ordinance contains a number of provisions for control of air pollution problems. Principal among them are the limitations on external effects which apply to all land uses. One of these limitations requires that "Every use shall be so operated that it does not emit an obnoxious or dangerous degree of heat, glare, radiation or fumes beyond any boundary line of the zone lot on which the use is located." If a broad definition is applied to the word "fumes" this limitation could be used to effect some control over air pollution sources. However, a very limited meaning is given to the word "fumes" in the proposed air pollution control ordinance. Other limitations regulating external effects

can be used to control wind-borne dusts from material storage piles, etc. and to require storage in closed containers of materials which might cause dust or fumes, thus reducing or eliminating certain air pollution problems. The zoning ordinance requires compliance with these "external effects" provisions within three years of the effective date, November 7, 1956.

Other provisions of the zoning ordinance prohibit establishment of residential uses in business or industrial areas. This restriction will afford some protection from the local area type problem. It also requires contractors' yards and off-street parking lots to be dust-free and requires air pollution control measures on storage reservoirs containing poisonous, toxic, or caustic materials.

The zoning map indicates that land uses planned for the future will, in general, provide buffer zones of unobjectionable, nonresidential uses between residential areas and industrial areas.

The provision that all nonconforming uses, of which there are many, be registered and that they be discontinued within 15 years will promote the separation of likely major pollution sources and residential areas and thereby eliminate certain existing local area-type problems. Provision has also been made to prevent operation of commercial enterprises which are likely to cause minor local air pollution problems in residential areas, e.g., dry cleaners, laundries, auto body shops, poultry dressing, tire recapping, etc.

Building Code Provisions: Chapter 37 of the building code promulgates standards for the construction of incinerators which can be used in some limited measure to insure the construction of well designed units which will tend to create less air pollution, when operated, than poorly

designed units. The chapter does not require multiple chamber incinerators which have been found to be most desirable from an air pollution standpoint. Section 3715 specifically prohibits construction of flue-fed incinerators and of ashpits for uses other than the storage of ashes, cans, or rubbish, and prohibits the use of ashpits constructed after October 2, 1954, for incineration.

Chapter 57 of the building code regulates the construction of warm heating plants. These regulations will be of some assistance in controlling these as pollution sources.

Section 2800 of the building code prohibits burning of any materials on building wrecking sites, thus preventing a likely cause of pollution. The section also requires control of dust during wrecking operations.

A boiler inspection activity in the building department helps to prevent operation of dilapidated plants, which often cause pollution.

A new ordinance requires garbage disposal units in all new buildings wherein garbage would be produced. This should tend to lessen expansion of hog feeding activities in the area, an activity which has caused air pollution problems.

Department of Health and Hospitals: Article 760 of the Revised Municipal Code of the City and County of Denver, dealing with nuisances, extends considerable authority to the Manager of Health and Hospitals in matters related to air pollution. The more important of the provisions are:

a. Authorizes manager to declare nuisance to exist whenever circumstances warrant and see to its abatement.

b. Declares unclean animal keeping and a number of businesses, when conducted in an offensive or annoying manner, to be a nuisance.

c. Regulates location of establishments wherein heat reduction of ores takes place.

d. Requires permits for certain animal enclosures and factories and provides for revocation of the permit if a nuisance is created.

Article 352 of the Denver Revised Municipal Code empowers the Manager of Health and Hospitals and others to exercise some control of back-yard burning operations. Provisions of particular interest are in sections .7-1 (2), .9-3 and .9-4. These powers can be used to ameliorate the existing unsatisfactory conditions (smoke, fly ash, odors, rat and fly infestation) associated with back-yard burners until a more desirable refuse disposal scheme can be implemented.

At this time, there is no formal air pollution control activity carried out by the Department of Health and Hospitals. However, an industrial health unit has been authorized and is being activated. This unit will need instruments, laboratory facilities and competencies which are closely related to those often included in air pollution control programs.

Article V of the Charter of the City and County of Denver authorizes the Department of Health and Hospitals to exercise all administrative functions pertaining to "the physical and mental health of the people" and authorizes the "promulgation of and enforcement of regulations necessary for the protection of the health of the people." Such authority would

probably be construed to include control of atmospheric pollution, if it were so desired.

A recently adopted State law assigns to the State Board of Health the power to "establish and enforce standards for exposure to toxic materials in the gaseous, liquid or solid phase, that may be deemed necessary for the protection of public health." Since local health units can enforce State laws, this act would also extend authority to the Denver (and Tri-County) Health Department.

It is understood that the City and County of Denver Department of Health and Hospitals can also seek control of any nuisance existing within one mile of the city which affects the people of the city; thus, it would be possible for the city authorities to cause abatement of air pollution nuisances within those limits.

TRI-COUNTY AREA

Authority vested in the Tri-County Health Department (serving Jefferson, Adams and Arapahoe Counties in their entirety) includes the power and duty "To abate nuisances when necessary for the purpose of eliminating sources of epidemic and communicable diseases affecting the public health" and "To initiate and carry out health programs, not inconsistent with the law, that may be deemed necessary or desirable for the protection of the public health and the control of disease."[28] This department can also utilize the provisions of the new State law relating to air pollution previously mentioned or rules and regulations which may be promulgated under its provisions.

At this time, there is no formal air pollution control activity in the Tri-County Health Department, although public complaints in this regard

are given the best possible attention, with abatement of the matter complained of being achieved in many cases. This limited activity cannot be expected to provide for a suitable program of air pollution control which will adequately restore and preserve the air resources of the area.

Zoning resolutions are now in effect in the three-county area which seek to provide for orderly development. However, at least one of the resolutions (Adams County) permits establishment of residential uses in industrial and other areas which can well lead to neighborhood problems of exposure to air pollution and to other problems. Zoning resolutions in the three counties are presently undergoing revision. Due consideration should be given to air pollution factors in these revisions.

There are building codes in the three counties and also in the larger incorporated municipalities. The one most generally used is the "Pacific Coast Code."[29] Sections of interest in air pollution control deal with provision of adequate draft for good combustion in fuel-burning devices and some general regulations concerning design of heating appliances.

INTERCOUNTY REGIONAL PLANNING COMMISSION

This agency is concerned with the planned growth of the Denver metropolitan area including Denver, Jefferson, Arapahoe, Adams, and Douglas Counties. Work is progressing on development of a comprehensive plan for the area including transportation, community development and renovation, parks, zoning, water resources, and others. The exact approach to these matters is still under development. However, the agency is in a position to seek great benefits for the area. Matters related to atmospheric pollution, particularly land use patterns and control program organization

are to be considered.

The Commission recently proposed a "Regional Service District Act,"[30] which was introduced in the State legislature in early 1957 but was not enacted. The bill was permissive in nature and if adopted, would have provided a legal basis for counties, either separately or together, to develop urban service systems on a regional basis to serve both incorporated and unincorporated areas.[31] The services which could have been provided under terms of the bill included air pollution control. If some such act is ever adopted, there would be some opportunity for development of a metropolitan air pollution control activity administered by a regional service district.

STATE OF COLORADO

The Colorado State Department of Public Health, Occupational Health Section, has undertaken, in cooperation with Denver authorities, some limited investigations of air pollution in Denver County as well as in other parts of the metropolitan area and the State. Some abatement work has been done. The section estimates that one man-year of time is spent on air pollution work each year. This group is equipped and staffed in such a way that considerable air pollution work could be done. However, fund and personnel limitations and other program obligations restrict this activity. It is considered possible, with the recent enactment of a State law giving the State Board of Health the power and duty to ". . . establish and enforce standards for exposure to toxic materials in the gaseous, liquid or solid phase, that may be deemed necessary for the protection of public health . . ." that funds for air pollution work will be granted. The State would then be in a better position to provide technical assistance

and other services to air pollution activities in the Denver area and other parts of the State. A committee is presently considering the matter of rules and regulations which may be warranted for implementation of the recently enacted law mentioned above.

VI. SUGGESTED APPROACH TO THE PROBLEM

LEGISLATION

As previously mentioned, a proposed air pollution control ordinance has been drafted for the City and County of Denver (Appendix C). If local authorities desire to seek adoption of such an ordinance, it is suggested that consideration be given to the following possible modifications of the present draft:

a. Section 5601 (a)--Delete the word "severe" before the word "annoyance"; add the words "or animals or vegetation" after the words "property of any kind."

b. Section 5601 (e)--Reword as follows: Dusts are gas- or air-borne solid materials, including but not limited to fly ash, cinders and soot.

c. Section 5601 (f)--Add the words "gas- or air-borne" after the words "fumes are."

d. Section 5601 (j)--Add the words "or other approved device" after the word "incinerator."

e. Section 5601 (o)--Use the definition: "Small gas- and air-borne particles consisting essentially of carbonaceous material in sufficient quantity to be observable."

f. Section 5602--It appears that the intent is to have six "regular members" of the Air Pollution Control Board but qualifications are given for only five. It is suggested that the sixth regular member be a representative from the legal profession. It would be well to indicate the manner in which a chairman is designated and the minimum number of

meetings to be held and how they are to be called.

g. Section 5603--There could also be a clause in this section prohibiting construction, reconstruction conversion or substantial alteration of installations, equipment or devices, for which a permit is required, without first obtaining said permit; and further prohibiting such construction, etc. in a manner other than set out in the approved plans. It would be well to indicate that failure to comply with any of the other provisions of the article or of the rules, regulations or standards adopted thereunder or of any lawful order of the Chief Building Inspector also shall be unlawful.

h. Section 5603 (d)--In view of the existing widespread violation of this section, the air pollution control board would have to make provision to grant temporary permission to burn refuse in other than the prescribed manner until other arrangements can be made for refuse disposal.

i. Section 5604 (1)--The provisions of Section 203 of the building code are not directly applicable to air pollution control problems. It is suggested that the manner of obtaining abatement of violations be set forth in the new ordinance.

j. Section 5604 (2)--Add the words "require submission of and to" after the first word "To."

In order to reduce the work load coincidental with this plan-approval scheme, a great many devices "that might or could produce air pollution" can be exempted from

this provision without appreciably weakening the control program. Such installations as standard gas-fired equipment, units burning No. 1 or No. 2 fuel oil in standard commercial equipment, small solid fuel-burning units and all temporary units could be exempted. Minor repair and alterations may also be excluded. To accomplish this end, the following could be added to Section 5604 (2): "The Air Pollution Control Board may exempt such classes of equipment, devices and activities from the provisions of this clause as it may deem appropriate, in keeping with the purposes of this article."

k. Section 5604 (3)--Consideration could be given to the addition of the following: "and make, or require any person to have made at his own expense and in a manner approved by the Chief Building Inspector, such tests or determinations as may be necessary to determine compliance with the provisions of this article or of the rules and regulations promulgated hereunder."

l. Section 5604--Authority could also be granted to the Chief Building Inspector to:

   a. Carry on such other investigations as may be necessary to further the purposes of the article.

   b. Recommend to the Air Pollution Control Board such rules and regulations or amendments thereof as may be necessary for the control of air pollution.

m. Section 5605--Authority could also be granted to the Air Pollution Control Board to:

   a. Compel attendance of witnesses and take their testimony under oath.

   b. Establish fees to be paid for filing of plans, issuance of permits and other purposes.

   c. Revoke or modify standards, rules, and regulations (in addition to adopting and promulgating).

n. Section 5606--Application of the provisions of Section 222 of the building code to appeals to the Air Pollution Control Board could lead to uncertainties and conflicts. It would be better to set forth the hearing procedures in the new ordinance.

It would be well to define penalties for violation of the article and provide that each day of violation be a separate offense. It is understood that the general severability clause in the building code would apply to this article, although in Section 394 of said code, no reference is made to rules or regulations adopted thereunder. It may be found desirable to provide for registration of certain classes of activities or equipment which may create air pollution. Information that would indicate the pollutants discharged could be obtained along with other pertinent data which would facilitate determination of the total pollution discharged into the air over the city and aid in guiding the control program into the most beneficial activities. Provision for such registration could be set forth in the ordinance or in rules and regulations adopted by the Air Pollution Control Board.

If local authorities in Jefferson, Arapahoe and Adams Counties decide to carry on an air pollution control program, some form of legislative authority will be needed. It is felt that the most advantageous procedure would be adoption of rules and regulations by the Tri-County Board of Health providing for definitions, standards of performance, authority of the director of the Tri-County Health Department, unlawful acts, permit requirements, legal remedies, etc., as may be deemed necessary. Provisions along the same lines as those contemplated for the City and County of Denver might be appropriate. If rules and regulations are adopted by the Colorado State Board of Health, they may be utilized as appropriate.

Considerable benefit would accrue to the metropolitan area as a whole if the provisions of air pollution control legislation, particularly performance standards, were uniform throughout the urbanized area. Now, while such provisions are either nonexistent or being revised, is the most desirable time to provide such uniformity. Efforts toward coordination could be made, through conferences, reciprocal participation in official and unofficial meetings and planning sessions, to secure a uniform legislative basis for the programs envisioned. Continuing attention to such matters would also be advantageous.

ORGANIZATION OF CONTROL PROGRAM

The most desirable program would be one which would serve the entire metropolitan area. Such a program would be best able to obtain and make efficient use of specialized, costly equipment and laboratory facilities, and of trained, experienced personnel. Such an area-wide organization could conceivably come about through some regional service district

procedure or perhaps through consolidation of some existing governmental functions in the four counties interested. However, the needs for early program activity and the uncertainties of creation of any area-wide organization make the use of some other organizational structure advisable until efforts to establish an area-wide arrangement succeed.

Even though a formal area-wide program is improbable at this time, agencies engaged in air pollution work can share consultative services, specialized equipment, facilities and personnel, either on a formal or informal basis. Much can be done to achieve the desired uniformity of regulations and programs through regular meetings and joint participation, unofficially, in preparation of rules, regulations, standards or other program bases. Development of an active area-wide advisory committee, with members representing the various governmental agencies concerned would be one means of promoting programs in the best interest of the community as a whole.

Within the City and County of Denver, the organization for air pollution activities might logically be centered in the Building Department of the Department of Health and Hospitals. The decision as to where the activity should be placed must be made by local authorities. Considerations in reaching this decision include:

1. Where in the two agencies are the staff and facilities presently most nearly similar to those contemplated for air pollution control work?
2. What intra-city governmental relationships will prevail with the activity in one agency or another and what will be required to provide a smooth-running operation which will serve the public well?

3. What agencies outside the city government will be involved and which city agency could best work with them?

4. What activities related to air pollution control are presently being carried out by the two agencies and what would be the effect on these related activities, from the standpoint of internal efficiency and public service, of placing air pollution control in one agency or another?

In any event, arrangements can be made for one operating group to perform many of the activities related to air pollution control regardless of the location of the principal air pollution control activity within the city organization.

Within Jefferson, Adams, and Arapahoe Counties, it is felt that the most suitable agency to assume responsibility for air pollution control is the Tri-County Health Department. No other activity is supported by a large enough population to make a fully successful activity possible. Although this agency serves the entire area of these three counties, the major portion of the air pollution problem will be in the relatively small urbanized area surrounding Denver. However, it is also true that the large majority of the people served by the agency live in the urbanized area. It is felt that no major organizational changes will be necessary for the department to undertake air pollution control work, with the exception of the possible addition of another unit within the organization.

There appears to be no factor which would prevent the Tri-County Health Department from obtaining technical air pollution services from

the City and County of Denver on some sort of contract arrangement. With such arrangements, the Tri-County unit could obtain needed services on a part-time basis which it might not be able to afford to maintain on a full-time basis, provided the City and County activity were in a position to provide such services. Any enforcement actions necessary would be accomplished by Tri-County personnel. This sort of arrangement would also tend to strengthen the City and County activity by making it possible to maintain a larger, perhaps more nearly complete activity.

Both the City and Tri-County activities will probably find it desirable to maintain close contact with the State Department of Public Health for purposes of obtaining whatever advice, technical consultation or assistance that agency may be in a position to provide. Also, close contact and mutual assistance is desirable between air pollution organizations and those responsible for zoning, area planning, building code enforcement, and refuse disposal. Contact with individuals and groups representing the public, commerce, industry, transportation, educational institutions, the press, radio, television and others should all be provided for in the over-all organization of the community effort.

PROGRAM

As previously discussed, a uniform program throughout the area is felt to be desirable. Many aspects of the program can be carried out separately by all concerned agencies working from uniform program bases. However, portions of the program will have to be especially well integrated to be fully successful, and perhaps can best be carried out with basic responsibility resting in one agency with other agencies playing supporting roles. These portions include the emission inventory,

meteorological study, and refuse-handling program discussed below.

Pollution Emission Inventory: In order to determine more exactly what activities in the community are causing discharge of pollutants into the air, an emission inventory is needed. The information should be secured before rules and regulations are prepared governing activities which may cause pollution. This inventory would provide valuable assistance in the design of a control program so that the most important problems could be attacked first and expensive, unnecessary activities avoided. Inventories of sufficient accuracy for program development can be prepared through study and evaluation of existing information relative to magnitude, equipment, materials, and practices associated with these activities. The study might cost in the neighborhood of $6000 to $8000. It can be accomplished by regular personnel or procured through contract arrangements, perhaps with the local universities or agencies associated with them or other research agencies.

Meteorological Study: In order to plan land uses for the protection of residential areas from air pollution by locating these areas away from the usual flow paths of relatively highly polluted air, a meteorological study is needed. Results of this study would be integrated into planning programs. A limited survey of this kind is reported to have been made in determining the most suitable site for the Rocky Mountain Arsenal. A great deal of information on meteorological patterns is already available in the area and might be sufficient for the planning program. If it is, the further action required would involve only an analysis of the information. If not, additional meteorological observations would be needed. Knowledge of the distribution of existing pollution sources throughout

the area would be obtainable from the emission inventory described above. This meteorological study would best be done through a contractual or consultative arrangement.

Refuse Handling Program: There is no doubt that present refuse-burning practices are causing a considerable contribution of pollution to the atmosphere, along with other unsatisfactory conditions. The possible remedies to the problem have been explored,[12] but action is still to be taken. If a fully satisfactory degree of atmospheric quality is to be achieved, the present practice of burning refuse will have to be discontinued throughout the urbanized area.

Other City and County of Denver Activity: Within the City and County of Denver, other program activities might include:

a. Make program-initiated determinations by observation and testing of air pollution emission violations with suitable abatement action.

b. Examine plans, issue permits and make inspections relative to construction or substantial modification of certain selected types of equipment, devices, and installations which may cause air pollution problems to insure establishment of facilities that will not likely be troublesome.

c. Make routine measurements of a few materials in the air, such as suspended particulate matter, dustfall, soiling particles, and others found to be present in important quantities through periodic analysis. The purpose of these measurements would be to observe trends and accumulate helpful information for better determining the nature and magnitude of needed control actions

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and perhaps for assessment of the physiological significance of pollutants present over a period of years.

d. Seek abatement of the causes of justified public complaints.

e. Carry on a planned program of control of those classes of activities causing pollution.

f. Conduct investigations of emissions from particular sources to determine compliance with rules and regulations, to assess the importance of the sources or to determine the efficiency of control equipment.

g. Compile a register of pollution sources by class of activity in some cases, and by individual premises in other cases. Such a compilation would assist in the preparation of an emission inventory, in the guidance of available resources into the most suitable channels, and in keeping informed of those pollution sources which may create problems.

h. Conduct a program of public education for the purposes of obtaining support, cooperation, and understanding.

i. Lend support and influence to work being done or to be done by others, which will be of benefit to the area, such as that on control of auto exhaust emissions.

j. Work with those engaged in zoning, planning, refuse disposal, building code enforcement, and other activities related to air pollution.

Other Tri-County Activity: Within the Tri-County area, in addition to the three joint activities with other air pollution control units in the area described above, program content could be essentially the same

as that outlined above for the City and County of Denver, but of reduced magnitude and complexity and with greater utilization of the previously mentioned acquisition of services by arrangements with official or private agencies.

STAFF, FACILITIES AND BUDGET

In order to carry out the program suggested for the City and County of Denver, a staff of 6 to 12 people would be required, depending on the rate of progress desired. The key person in direct charge of the activity must be qualified to supervise and participate in the technical phases of the work and, at the same time, be able to assume main responsibility for administration of the program, represent the city in all matters relative to air pollution and gather public support for the program. It is felt that no present officials can assume this responsibility in addition to their current duties beyond providing broad administrative leadership. Those with backgrounds in chemical, mechanical or public health engineering and experience in governmental programs will probably be found most adequately equipped to carry out this responsibility. A starting salary of $8000 to $9000 a year will probably be required to obtain the desired competence.

In addition to the person in charge of the program, need for the following personnel would be indicated: one to three chemical, mechanical or public health engineers; one chemist; one to three inspectors (present career service designation—Air Pollution Control Inspector II); one to three clerical people; and an engineering-laboratory aid. Total personal services costs of such a staff would be $30,000 to $60,000 a year.

Assuming that basic laboratory space and facilities can be made available for two people, expenditure of about $1500 to $2500 for additional laboratory apparatus and supplies would be indicated. Acquisition of a moderate amount of field equipment for measurement of pollution in the general atmosphere and in stacks would cost about $1500 to $2500. Perhaps one automatic recording pollution measuring instrument could be purchased at a cost of from $3000 to $4000. Suitable arrangements for transportation would have to be made. Various other supplies, services and equipment would require perhaps from $3000 to $4000 (chemicals, sampling supplies, consultant fees, furniture, technical books, etc.). Also, since personnel may be relatively new to the field of air pollution, it is suggested that $1000 to $2000 be provided for sending staff members to training courses, seminars and technical conferences.

The total cost of the program would be from $38,000 to $80,000 annually, depending on the magnitude of the program developed. This is an expenditure of 7 to 16 cents per capita. In 1956, expenditures for air pollution control purposes in eleven other cities of comparable size ranged from 2 to 24 cents per capita and averaged 9 cents per capita. In any event, expenditures for the first year of operation may be considerably below those anticipated for the ultimate program because of delays which occur in recruitment of personnel. Equipment costs, however, will be greater in the early stages of the program.

To carry out the program suggested for the Tri-County area, a staff of 4 to 7 people would be required, depending on the rate of progress desired. Qualifications of the program director would be similar to those described for the director of the City and County of Denver program with

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perhaps somewhat less experience. He also would have to be able to carry out the program with only general administrative guidance since present personnel in the Tri-County Health Department would likely be unable to spare enough time from present responsibilities. A salary of $7000 to $7500 a year will probably be required to obtain the desired competence. Additional personnel could include one or two chemical, mechanical or public health engineers, one to three inspectors, and a clerical person. Total personal service costs with such a staff would be $21,000 to $36,000 a year. Other expenses would include perhaps $1000 to $2000 for acquisition of a modest amount of special laboratory and field equipment, a suitable amount for local transportation expenses, and about $1000 for travel expenses in training and orienting personnel. In order to provide for procurement of the more specialized, complex services needed in certain atmospheric pollution monitoring and stack sampling and perhaps to contribute toward accomplishment of area-wide studies, $2000 to $5000 could be provided for contractual or consultative services.

The total cost of this program would be $26,000 to $45,000 annually. This is an expenditure of 10 to 17 cents per capita. First-year expenses could be considerably lower due to factors previously described.

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APPENDIX A

INFORMATIONAL TABLES

TABLE 5

POPULATION DENSITIES OF SELECTED CITIES, 1950[14]

City	Population	Area sq. miles	Population density in people/sq. mile
San Antonio, Tex.	406,811	35.8	11,300
Dallas, Tex.	432,927	41.8	10,300
Columbus, Ohio	374,440	39.5	9,470
Louisville, Ky.	367,359	40.8	9,000
Indianapolis, Ind.	424,683	53.7	7,890
Kansas City, Mo.	453,290	59.4	7,630
Denver, Colo.	415,786	67.2	6,200
Seattle, Wash.	462.440	80.7	5,730
Portland, Ore..	371,011	66.9	5,550

TABLE 6

POPULATION, POPULATION DENSITY AND AREA GROWTH,
CITY AND COUNTY OF DENVER[12]

Year	Population	Area in sq. miles	Population density in people/sq. mile
1930	387,861	58.8	4,900
1940	322,412	58.8	5,490
1950	415,786	67.2	6,200
1954	460,000	68.8	6,690
1960	515,000	77.8	6,620
1970	600,000	88.0	6,820

TABLE 7

EMPLOYMENT BY MAJOR INDUSTRY GROUPS
DENVER METROPOLITAN AREA, 1940 and 1950[8]

Industry	Number of workers		Percent of workers		Increase in no. of workers 1940-50	Percent of increase
	1940	1950	1940	1950		
Agriculture	6,911	6,828	4.9	3.1	-83	-0.1
Mining	988	710	0.7	0.3	-278	-0.4
Manufacturing	20,937	36,164	14.9	16.6	15,227	19.6
Wholesale trade(a)	9,403	16,800	6.7	7.7	7,397	9.5
Retail trade	25,551	35,972	19.2	16.5	10,421	13.4
Finance, insurance, real estate	7,811	11,220	5.6	5.1	3,409	4.3
Business, personal services	19,865	24,246	14.2	11.1	4,381	5.6
Professional services	14,611	24,493	10.4	11.2	9,882	12.7
Transportation	10,661	16,934	7.6	7.8	6,273	8.1
Communication, utilities	4,419	7,889	3.2	3.6	3,470	4.5
Construction	8,224	18,038	5.9	8.3	9,814	12.6
Government(b)	7,387	15,024	5.3	6.9	7,637	9.8
All other	3,391	3,680	2.4	1.8	289	0.4
Totals	140,159	217,998	100.0	100.0	77,839	100.0

(a) Figures adjusted to 1939 and 1948 Census of Business.

(b) Includes all those activities which are uniquely governmental functions. Government agencies engaged in activities commonly carried on also by private enterprises are classified in the proper industrial category.

TABLE 8

EMPLOYMENT AND NUMBER OF FIRMS IN MANUFACTURING, BY MAJOR INDUSTRY GROUPS, DENVER METROPOLITAN AREA[9]

Industry	1951			Estimated 1970	
	No. of firms	Total employment	% of mfg. employment	Total employment	% of mfg. employment
Food and related products	105	10,771	26.7	14,670	28.2
Textile mill products	19	871	2.2	1,180	2.3
Furniture and fixtures	31	725	1.8	1,050	2.1
Office supplies	6	381	0.9	560	1.1
Printing, engraving and related industries	51	2,988	7.4	4,350	8.4
Luggage	4	1,827	4.5	2,240	4.3
Chemicals and allied products	22	1,831	4.5	2,250	4.3
Petroleum products	12	811	2.0	1,060	2.0
Rubber products and related fittings	3	5,748	14.3	6,160	11.9
Construction material (exc. structural steel)	27	1,613	4.0	2,310	4.5
Structural steel and castings	18	1,525	3.8	2,000	3.9
Machinery	52	4,336	10.8	5,100	9.8
Transportation equipment	14	1,127	2.8	1,470	2.9
Scientific instruments	13	636	1.6	830	1.6
Miscellaneous	138	5,074	12.7	6,670	12.7
Totals	515	40,264	100.0	51,900	100.0

TABLE 9

SIZE OF MANUFACTURING ESTABLISHMENTS
DENVER METROPOLITAN AREA, DECEMBER 1951[10]

Size of establishment (number of employees)	Establishments		Percent of total employees
	Number	Percent of total	
0 - 24	283	53.7	8.3
25 - 49	96	18.3	8.6
50 - 74	44	8.4	6.5
75 - 99	21	4.0	4.6
100 - 149	32	6.1	9.9
150 - 199	16	3.0	6.8
200 - 249	11	2.1	6.2
250 - 499	14	2.7	12.0
500 - 999	5	0.9	10.5
Over 1000	4	0.8	26.6
Totals	526	100.0	100.0

TABLE 10

DISTRIBUTION OF MANUFACTURING ESTABLISHMENTS AND EMPLOYMENT
IN THE DENVER STANDARD METROPOLITAN AREA
1947 AND 1954[20]

	Percent of manufacturing employment	Percent of manufacturing establishments			
		1-19 employees	20-99 employees	100 or more employees	All establishments
Denver County					
Percent 1954	83	84	86	87	84
Percent 1947	90	91	93	88	92
Jefferson, Adams and Arapahoe Counties					
Percent 1954	17	16	14	13	16
Percent 1947	10	9	7	12	8

TABLE 11

AVERAGE HOURLY WIND VELOCITIES AND DIRECTIONS, DENVER, COLORADO[23]

Month	A.M.												P.M.											
	1	2	3	4	5	6	7	8	9	10	11	Noon	1	2	3	4	5	6	7	8	9	10	11	Mid't	Mean
	Average Hourly Wind Velocity (M.P.H.)(1881-1930)																								
Jan.	7.2	7.3	7.2	7.2	7.2	7.3	7.5	7.5	7.7	7.7	8.0	8.3	9.1	9.3	9.5	9.1	8.4	7.7	7.3	7.1	7.1	7.1	7.2	7.1	7.8
Feb.	6.9	6.9	6.9	6.8	6.7	6.8	6.8	7.0	7.3	7.6	8.2	8.8	9.5	10.0	10.1	10.2	9.7	8.3	7.2	6.7	6.9	6.8	6.8	6.9	7.7
Mar.	6.9	6.9	6.8	6.8	6.8	6.8	6.9	7.0	7.5	8.0	8.7	9.5	10.2	10.7	11.0	11.2	11.1	10.1	8.7	7.8	7.1	6.9	6.9	6.9	8.2
Apr.	7.0	6.8	6.8	6.7	6.5	6.5	6.6	6.9	7.4	8.0	8.8	9.4	10.2	10.6	10.9	11.2	11.2	10.6	9.3	8.4	7.7	7.4	7.1	7.0	8.3
May	6.5	6.3	6.0	5.8	5.7	5.7	5.7	6.2	6.8	7.6	8.3	8.9	9.6	10.3	10.6	10.8	10.8	10.2	9.3	8.4	7.7	7.1	6.8	6.7	7.8
June	6.3	6.1	5.9	5.7	5.5	5.3	5.3	5.7	6.1	6.7	7.6	8.3	9.1	9.6	10.2	10.5	10.5	10.1	9.1	8.0	7.3	6.8	6.7	6.5	7.5
July	6.3	6.1	5.7	5.4	5.2	5.1	5.0	5.3	5.5	5.9	6.6	7.2	7.9	8.6	9.4	9.6	9.7	9.3	8.5	7.7	7.2	6.8	6.7	6.5	6.9
Aug.	6.2	6.0	5.9	5.6	5.5	5.3	5.1	5.0	5.1	5.4	6.3	6.9	7.7	8.1	8.7	9.1	9.3	8.6	7.7	7.1	6.6	6.6	6.4	6.3	6.7
Sept.	6.3	6.3	6.1	6.0	6.0	5.9	5.9	5.6	5.7	5.9	6.5	7.1	7.8	8.1	8.6	8.8	8.7	8.0	7.2	6.7	6.3	6.4	6.5	6.3	6.8
Oct.	6.7	6.5	6.5	6.4	6.5	6.6	6.6	6.4	6.4	6.5	7.0	7.6	8.2	8.7	9.0	8.8	8.5	7.5	6.7	6.3	6.4	6.6	6.8	6.8	7.1
Nov.	7.0	7.1	7.1	7.2	7.3	7.3	7.4	7.4	7.4	7.1	7.4	7.8	8.4	8.5	8.6	8.5	7.7	6.8	6.4	6.7	7.0	7.2	7.1	7.1	7.4
Dec.	7.3	7.4	7.4	7.5	7.5	7.6	7.6	7.7	7.7	7.7	7.8	8.1	8.6	8.7	8.7	8.3	7.6	7.0	6.8	7.0	7.1	7.2	7.3	7.2	7.6
	Prevailing Wind Direction (1892-1930)																								
Jan.	S	S	S	S	S	S	S	S	S	S	S	S	S	NE	NE	N	NE	NE	S	S	S	S	S	S	S
Feb.	S	S	S	S	S	S	S	S	S	S	S	NE	NE	NE	NE	NE	NE	NE	N	S	S	S	S	S	S
Mar.	S	S	S	S	S	S	S	S	S	S	N	N	NE	N	NE	NE	NW	N	N	N	S	S	S	S	S
Apr.	S	S	S	S	S	S	S	S	N	N	NE	NE	NE	NE	NE	NE	NE	N	NE	N	SW	S	S	S	S
May	S	S	S	S	S	S	S	S	S	N	NE	NE	NE	NE	NE	NW	NE	NE	NE	NE	SW	S	S	S	S
June	S	S	S	S	S	S	S	S	S	N	NE	NE	NE	NE	NE	NE	N	NE	NE	NW	S	S	S	S	S
July	S	S	S	S	S	S	S	S	S	N	NE	NE	NE	N	N	N	N	SW	S	S	S	S	S	S	S
Aug.	S	S	S	S	S	S	S	S	S	NE	NE	NE	NE	NE	N	N	N	NW	SE	S	S	S	S	S	S
Sept.	S	S	S	S	S	S	S	S	S	S	NE	NE	NE	NE	NE	N	NE	N	N	S	S	S	S	S	S
Oct.	S	S	S	S	S	S	S	S	S	S	NE	NE	NE	NE	NE	NE	NE	NE	NE	S	S	S	S	S	S
Nov.	S	S	S	S	S	S	S	S	S	S	S	S	NE	NE	NE	NE	NE	N	S	S	S	S	S	S	S
Dec.	S	S	S	S	S	S	S	S	S	S	S	S	S	N	NE	N	N	S	S	S	S	S	S	S	S

APPENDIX B

AIR POLLUTION EMISSIONS

INFORMATION RELATIVE TO AIR POLLUTANTS DISCHARGED FROM SEVERAL ACTIVITIES

NOTE:

The data contained in this appendix are of value only as general information on the nature and extent of pollution from the several activities. They must not be applied to any specific situation without due consideration of many factors which have great effects on pollution emissions. Also, the various emissions may contain other components not recorded in the particular reference source cited.

TABLE 12

EMISSION OF POLLUTANTS FROM COMBUSTION OF FUEL GAS AND FUEL OIL[32]

Component	Pounds emitted per ton of fuel burned	
	Gas	Oil
Aldehydes	2.	2.4
Nitrogen Oxides	14.	26.
Acids (as HOAc)	2.5	30.
Organics	3.	10.
Solids	-	0.5
Sulfur Oxides	0.3	60.

TABLE 13

EMISSIONS FROM BURNING REFUSE IN A MUNICIPAL INCINERATOR[34,36]

Component	Emission in ~~pounds~~ weight per cent of refuse burned
Organics[34]	0.06
Aldehydes (as formaldehyde)[34]	0.07
Acids (as acetic acid)[34]	0.03
Sulfur Oxides (as SO_2)[34]	0.1
Nitrogen Oxides (as NO_2)[34]	0.1
Ammonia[34]	0.02
Solids[36]	~~0.435~~

SEE NOTE ON PAGE 65

TABLE 14

EMISSIONS FROM BURNING REFUSE IN BACK-YARD INCINERATORS[35]

Component	Emissions in pounds per ton of refuse burned
Methanol	9 - 23
Ethylene	8 - 61
Acetone	> 8
Methane	23 - 150
Acetylene	< 4 - 73
∝ Olefins (as propylene)	< 6
Carbonyl Sulfide	> 3
Benzene	> 3
Acids (as acetic acid)	> 4
Phenols (as phenol)	> 8
Aldehydes (as formaldehyde)	5 - 64
Ammonia (may include some from low molecular weight amines)	0.9 - 4
Oxides of Nitrogen (as NO_2)	< 0.1
Acetaldehyde	Present
Guaiacol	Present
Carbon Monoxide	197 - 990
Esters	Present

SEE NOTE ON PAGE 65

TABLE 15

EMISSIONS FROM AUTOMOBILE ENGINES[32]

Component	Emissions in pounds per ton of gasoline burned
Aldehydes (CHO)	6.
Ammonia	0.7
Nitrogen Oxides (NO_2)	8.
Acids (HOAc)	0.6
Organics	70.
Solids (Carbon)	0.1
Sulfur Oxides	5.7

TABLE 16

EMISSIONS FROM DIESEL ENGINES[33]

Component	Emissions in pounds per ton of diesel fuel burned
Particulates	34
Oxides of Nitrogen (as NO_2)	49
Sulfur Dioxide	10
Lower Aldehydes (as Formaldehyde)	5
Organic Acids (as Acetic Acid)	10

SEE NOTE ON PAGE 65

TABLE 17

PRINCIPAL EMISSIONS FROM BURNING OF COAL

Component	Pounds emitted per ton of coal burned
Solids	200
Sulfur Dioxide	40
Nitrogen Oxides (as NO_2)	8
Organics	20
Acids (as CH_3COOH)	30

GASOLINE HANDLING LOSSES

5.20
~~1.37~~ tons per 100,000 gallons handled including losses from marketing, filling service station tanks, filling automobile tanks, and evaporation from automobile tanks and carburetors.

SEE NOTE ON PAGE 65

APPENDIX C

PROPOSED AIR POLLUTION CONTROL ORDINANCE DRAFTED BY DENVER AUTHORITIES

BY AUTHORITY

ORDINANCE NO.____ COUNCILMAN'S BILL NO.____

SERIES OF 1956 INTRODUCTED BY COUNCILMAN

_____

A B I L L

FOR AN ORDINANCE REPEALING ARTICLE 762 OF THE REVISED MUNICIPAL CODE, AS AMENDED, AND AMENDING THE BUILDING CODE, AS AMENDED, BY ADDING THERETO A NEW CHAPTER 56, ESTABLISHING AN AIR POLLUTION CONTROL BOARD: AND RELATING TO AND REGULATING THE PRODUCTION AND EMISSION OF SMOKE, TOXIC OR OFFENSIVE GASES, VAPORS, FUMES, MIST, DUST, RADIATIONS, SOOT, CINDERS AND FLY ASH AND ODORS WITHIN THE CITY AND COUNTY OF DENVER: THE USE AND OPERATION OF FUEL-BURNING AND REFUSE-BURNING PLANTS, PROCESSES, EQUIPMENT AND DEVICES, APPROVAL OF PLANS THEREFOR AND FOR THE REPAIR THEREOF, AND INSPECTION THEREOF: AUTHORIZING THE MAKING OF TESTS AND THE ADOPTION AND PROMULGATION OF RULES, REGULATIONS AND STANDARDS, THE ISSUANCE OF SUMMONS AND SUBSEQUENT FINES; AND FOR THE CONTROL AND REGULATION OF AIR POLLUTION AND THE ABATEMENT OF SURFACE DUST.

BE IT ENACTED BY THE COUNCIL OF THE CITY AND COUNTY OF DENVER:

SECTION 1. That Article 762 of the Revised Municipal Code, as amended, is hereby repealed.

SECTION 2. That the Building Code, as amended, is hereby amended by addition thereto of a new Chapter 56 as follows:

CHAPTER 56--AIR POLLUTION CODE

SECTION 5601. DEFINITIONS. General. The following words, phrases, terms and their derivatives shall be interpreted as set forth in this Section.

(a) Air Pollution. Air Pollution shall mean the emission or discharge into the air of dust, fumes, gas, mist, odors, smoke or vapor, or any combination thereof, of a character and in a quantity which is detrimental to public health, welfare or safety or causes severe annoyance or discomfort to the inhabitants of the City and County of Denver, because of inherent chemical and physical properties, or causes, or is likely to cause injury or damage to real or personal property of any kind, or which interferes with normal conduct of business.

(b) Approved. Approved shall mean acceptance by the Chief Building Inspector or the Air Pollution Control Board as the result of investigations or tests by either, or by reason of accepted principles or tests by recognized national authorities, technical or scientific organizations.

(c) Board. Board shall mean the Air Pollution Control Board.

(d) Chief Building Inspector. Chief Building Inspector shall mean the Chief Building Inspector of the City and County of Denver or his authorized representatives.

(e) Dusts. Dusts are solid materials that have dispersed by disintegration, including fly ash, cinders and soot.

(f) Fumes. Fumes are colloidal systems formed by combustion, distillation, sublimation, calcination, chemical reactions or condensation.

(g) Garbage. Garbage shall mean waste from the preparation, cooking and consumption of food and includes refuse and waste from the handling, storage, preparation and sales of produce.

(h) Gases. Gases are chemical substances in the vapor phase.

(i) Mists. Mists are droplets of liquid of varying diameters in the atmosphere caused by condensation or atomization.

(j) Open Fire. Burning in the open or in anything except an approved incinerator.

(k) Odor. Odor shall mean that property of a substance which affects the sense of smell.

(l) Person. Person shall mean an individual, corporation or association including those acting in a fiduciary or representative capacity whether appointed by a court or otherwise and including any governmental unit, agency, officer or employee as to whom the City and County of Denver has the power to legislate.

(m) Refuse. Refuse shall mean a mixture of rubbish and garbage.

(n) Rubbish. Rubbish shall mean household rubbish, yard rubbish and building rubbish.

(o) Smoke. Smoke is a visible mixture of gases and particles of carbon produced by combustion.

(p) Vapors. Vapors are gases formed from liquids by an increase in temperatures.

SECTION 5602. Air Pollution Control Board; Membership: Terms, Compensation. There is hereby created an Air Pollution Control Board to consist of "regular members" and "ex-officio members." The regular members of the Board shall be legal residents of the City and County of Denver, and shall include:

1. A registered professional engineer licensed in the State of Colorado whose major specialty of work is chemical engineering.

2. A registered professional engineer licensed in the State of Colorado whose major specialty of work may be in any branch of engineering.

3. A doctor of medicine licensed to practice medicine in the State of Colorado.

4. Two private citizens whose occupations are wholly independent of all phases of the manufacturing or transportation industry.

The ex-officio members of the Board shall consist of:

1. The Chief Building Inspector, or his deputy, who shall act as Secretary of the Board.

2. The Manager of Health and Hospitals, who may designate to sit for him a qualified employee of his department.

3. The Manager of Public Works who may designate to sit for him a qualified employee of his department.

4. If he consents, the Executive Director of the Colorado State Department of Public Health or his representative.

The Chief Building Inspector or his deputy shall be without voting power. Any member of the Board who may have a direct or indirect personal interest in any case brought before the Board shall be disqualified to vote on that particular case.

Regular members of the Air Pollution Control Board shall serve for terms of three calendar years and may not serve for more than two consecutive terms. The regular members of the Air Pollution Board shall be appointed by the Mayor.

Within 30 days of the passage of this ordinance the Mayor shall appoint six (6) regular members of the Board of Air Pollution Control: two members to serve from the time this ordinance is adopted to January 1, 1957; two members to serve from the time this ordinance is adopted to January 1, 1958; and two members to serve from the time this ordinance is adopted to January 1, 1959. Every year commencing on January 1, 1957, the Mayor shall appoint two members to serve for a period of three years.

Compensation for regular members of the Board who are not employees of the City and County of Denver or of the State of Colorado shall be Twenty Dollars ($20) per meeting.

The Mayor may remove any regular member of the Air Pollution Control Board for inefficiency, neglect of duty or misconduct of office. The Mayor shall appoint a regular member to serve during the unexpired term of any member of the Board who resigns or is removed from the Board or to replace any member who may die during the term of his appointment.

SECTION 5603. Unlawful Acts. It shall be unlawful:

(a) To cause, emit or allow the emission or escape into the open air from any structure, machine, facility, plant premises or ground, of dust, fumes, gas, mist, odors, smoke, vapor or any combination thereof, of a quantity or character which constitutes air pollution as defined herein.

(b) To construct, reconstruct, convert, operate, add to or alter any installation, equipment, or device, or the appurtenances thereto, which by its operation or maintenance will emit or cause or allow the emission or escape into the open air of dust, fume, gas, mist, odor, smoke, vapor or any combination thereof, resulting in air pollution.

(c) For any person or user of land within the City and County to cause, permit or contribute to a change or disturbance in the natural or existing condition of the surface soil or any vegetation thereon without taking reasonable precautionary measures to prevent an increase in the production of dust or other surface debris by action of the wind.

(d) To burn garbage, refuse, waste meterial, junked vehicles or parts thereof, or any other material in an open fire except at such place and time and under such safeguards as may be prescribed by the Air Pollution Control Board.

SECTION 5604. Powers and duties of the Chief Building Inspector.

The Chief Building Inspector shall, in connection with this article, have the power and duty

1. To investigate conditions causing air pollution and to require by the procedure set out in Section 203 of the Building Code, the necessary and proper steps to abate the effect, hazard or nuisance thereof;

2. To examine applications, plans and specifications for the construction, reconstruction, conversion, addition or alteration of any installation, equipment or device and any equipment pertaining thereto, that might or could produce air pollution and to inspect installations and equipment for which a permit has been issued to see that installation will be made in accordance with this article and the rules, standards and regulations promulgated hereunder.

3. To inspect from time to time any installation, equipment, devices and appurtenances thereto that may, can or does cause air pollution;

4. To make reasonable requirements in the granting of any permit so as to enforce the provisions of this article and the Standards, rules and regulations adopted and promulgated hereunder;

5. To enforce otherwise, the provisions of this article and the rules, standards and regulations adopted and promulgated hereunder, and to commence and prosecute any action, legal or equitable, to punish and prevent violations of this article. Such powers, actions and remedies shall be concurrent and cumulative.

6. To disseminate information to the public on air pollution reduction and control.

7. To enlist the cooperation of civic, trade, technical, scientific, educational, governmental and other organizations in the control and reduction of air pollution.

SECTION 5605. Adoption and promulgation of Rules and Regulations by the Air Pollution Control Board.

The Air Pollution Control Board shall adopt and promulgate standards, rules and regulations. Such rules, standards and regulations shall be designed to control air pollution and to better effectuate the purpose of this article and to prevent and control air pollution and air pollution nuisance.

SECTION 5606. Appeals to the Air Pollution Control Board.

(a) Any person aggrieved by any decision, action or order of the Chief Building Inspector pertaining to air pollution control, may appeal such decision or order to the Air Pollution Control Board within fifteen days from the date of such decision, action or order. The procedure of Section 222 of this Code shall otherwise govern appeals.

SECTION 5607. Application for Injunction.

In addition to any other remedy under this article the City and County of Denver may apply to the District Court of the City and County of Denver for relief by injunction to enforce compliance with or restrain violations of any provisions of this article or any rules, standards and regulations adopted and promulgated hereunder. For this purpose any violation of this article is hereby declared to be a nuisance.

SECTION 3. The Council hereby finds this Ordinance is necessary for the immediate preservation of the public health and public safety, and determines that it shall take effect immediately upon its final passage and publication.

PASSED By the Council _____

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APPENDIX D

LETTER REQUESTING STUDY

December 3, 1956

Francis J. Weber, M.D.
Regional Medical Director
Department of Health, Education and Welfare
Public Health Service
Region VIII
525 New Custom House
Denver 2, Colorado

Dear Doctor Weber:

At the recent meeting concerning air pollution problems in the Denver area Mr. Frank DeMartini, Assistant Director of the Air Pollution Control Program of the Public Health Service, indicated that his division could make a study of the air pollution problem in the Denver Metropolitan area. Although he was unable to make a definite commitment, Mr. DeMartini indicated that such a study might be possible sometime during the month of January, 1957. At this time Mr. DeMartini was informed by the Denver Department of Health and Hospitals and the Denver Building Department that a request for such a survey would be made in the near future.

We respectfully request that representatives of the Community Air Pollution Control Program of the Public Health Service make a survey of the air pollution conditions in the Denver Metropolitan area as early as possible. We suggest that the survey include the following:

1. A "recommended survey" of air pollution conditions in the Denver Metropolitan area.

2. A review of existing and proposed industries which might contribute to air pollution conditions.

3. A review of existing air pollution control activities.

4. Recommendations concerning the following:

   a. Air pollution control legislation.

   b. Organization of control authorities.

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c. Additional technical studies.

d. Inspectional laboratory staff.

Facilities of our departments will be made available to the representatives of the Public Health Service in conducting such a survey.

We are indeed grateful for the assistance which the Public Health Service has already given us. We hope that you will feel free to contact us at any time for additional information concerning this important matter.

Very truly yours,

(Signed Lloyd Florio)
Lloyd Florio, M.D., Manager
Denver Department of Health and Hospitals

(Signed Donald Harter)
Donald S. Harter
Chief Building Inspector
City and County of Denver

(Signed William S. Haynes)
William S. Haynes, M.D., Director
Tri-County Health Department

LF:DSH:WSH:JRC:ace

Forwarded by:

(Signed R.L. Cleere)
Roy L. Cleere, M.D., Executive Director
Colorado State Department of Public Health

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